Dissertation on

A STUDY OF CLINICAL AND PROGNOSTIC FORECAST IN SNAKE BITE

Submitted for

M.D. DEGREE EXAMINATION

Branch -1

(GENERAL MEDICINE)

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THE TAMILNADU Dr. M.G.R MEDICAL UNIVERSITY

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.....IN SNAKEBITE.....

submitted by Dr. .....M. NALLATHAMBI..... **of**

Dept. of .....GENERAL MEDICINE..... **Thanjavur Medical College, Thanjavur**

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I , **Dr. NALLATHAMBI . M** , solemnly declare that dissertation titled A **STUDY OF CLINICAL AND PROGNOSTIC FORECAST IN SNAKE BITE** is a bonafide work done by me at Thanjavur Medical College Hospital during Jan 2016 – May 2016 under the guidance and supervision of Prof. **Dr. C. GANESAN, M.D**. HOD., Department of Internal Medicine.

The dissertation is submitted to **THE TAMILNADU Dr. M.G.R. MEDICAL UNIVERSITY, CHENNAI, TAMILNADU** as partial fulfillment for the requirement of M.D. Degree Examinations – Branch I (General Medicine) to be held in April 2017.

Place: Thanjavur

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DR. NALLATHAMBI.M

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INTRODUCTION

Snakes are a fascinating part of nature. Their color, movement and secretive habits make them more mysterious than other animals. There are over 300 species of snakes in the world, of which more than 200 ranging in size from 100 mm. Long worm snakes to 6 m long pythons are found in India.[1]

In India snakes have been worshipped as gods for thousands of years. Even today in Maharashtra during the harvest festival called “nagapanchami” freshly caught cobras are worshipped with flower, ghee and money. Most of us flee at the site of a snake. However group of people have based their living on these primitive reptiles.

In south India, the irula tribal’s over years have been supplying millions of snake skins for export. As this trade has been banned today. They catch snakes for venom extraction and this venom is then used in the process of antivenom production.[2]

Snake bite is a common emergency encountered in day to day practice. Morbidity and mortality due to snakebite is a preventable health hazard in the tropical and subtropical countries.

In India due to the prevailing climatic conditions and due to the fact that a major portion of the population is rural and agrarian, snakebite is a major health problem.[3]

Every year 15,000 die out of 2,00,000 snake bites in India. The death rate is approximately 1.5%. However this figure is based on hospital statistics whereas in practice most rural patients prefer treatment by traditional healer and do not go to hospitals.

Dr. Patrick Russell in 1976 work from, "India of snake bites". The progress of disease and succession of symptoms, had either not been attended to or were indistinctly recollected. His plea for the clinical observation remained largely unheeded for years until the landmark study in 1963 by Reid.[4]

It is a fact the effect of cobra bite kills the patient within minutes to hours, if managed sufficiently early with antisnake venom, the patient recovers soon. In the cases viper bites, which are more common, death occurs over days. Even in the absence of death, the morbidity is high. These factors necessitate aggressive and specific treatment.[5]

The effect of snake bites on the various body systems and their management still holds a lot of controversy. We have chosen a study on these clinical and prognostic profile and response to treatment as our institute is situated in a primarily rural setting. With high inflow of cases, mainly viper bites occurs.

AIMS OF STUDY

1. To document the local species of snakes that commonly cause various clinical features.

2. To analyze the time interval between the snakebite and the onset of various clinical features.

3. To find the correlation between the clinical profile and the time interval between bite and starting of treatment.

4. To correlate the clinical severity to the complications encountered by quantitative coagulation and renal function test.

5. To study the time taken for reversal of changes in clinical profile following ASV therapy.

6. To document the incidence of compartment syndrome and the prognosis of the patients with and without fasciotomy.

7. To analyze the complications of ASV therapy.

8. To study the time interval between the administration of ASV.

9. To study cardiovascular and neurological manifestations of snake bite

SAWSCALED VIPER

Russells Viper

Indian King Cobra

common Indian Krait

REVIEW OF LITERATURE

"An important phase of medicine is the ability to appraise the literature correctly" - Hippocrates

TAXONOMY, IDENTIFICATION AND DISTRIBUTION OF SNAKES

There are about 2500 – 3000 snake species, of which 500 belongs to five families of venomous snake. In India there are 236 snake species, among them 50 are poisonous. Among non venomous some are potentially dangerous they are South African and Asian pythons and the south American anaconda.

Poisonous snake prevalent in India among four families. They are

1. **Elapidae** – includes cobras and krait
2. **Viperidae** (true viper) – includes russell's and saw scaled viper
3. **Colubridae** (pit viper) - includes green pit viper
4. **Hydrophidae** or sea snakes[5]

In India although they are venomous, they are not threat to man.

The only venomous snakes to be wary of the "big four" - cobra, krait, Russell viper, saw scaled viper.[2]

COBRAS

Two species are found in India common cobra (Naja naja) and king cobra (ophiophagus hannah). Cobras vary in color from black or dark brown to yellow white. The head is indistinct from the neck and the ribs in the region is movable and expand to form the hood. The hood resembles a spectacle showing a pair of rings. They are confused with Indian rat, snakes with thin neck and head and 3 meters longer than Indian cobras (sara pambu). King cobras live in dense forest and grow upto 18 feet. They are usually black in color.

KRAIT

Two species are common in India common krait (kattu viriyan) and banded krait (pattai kattuviriyan). Common krait is steel blue or black with white bars on the back. Banded krait is larger and is jet black in color with yellow bars. Kraits are usually found in pairs

SAW SCALED VIPER

A small snake (30cm long) with brown or greyish dorsum showing zigzag pattern. It has a distinct cross or lance mark on the head. The ventral scales are rough. They produce a rasping soundby rubbing their coils together. This snake is confused with non poisonous cat snake which has a long tail, prominent eyes and a clear Y mark in head.

Most often a killed snake is brought by the patient and the physician has to identify whether poisonous or not. If the physician has a mental picture of the four common poisonous snakes it would be much easier for him to know which bite has to be given significance.

DIFFERENCE BETWEEN VENOMOUS AND NON-VENOMOUS SNAKES

Features	**Venomous Snakes**	**Non-Venomous Snakes**
Poison Apparatus	Present	Absent
Saliva	Toxic, contains toxic peptides and enzymes	Non toxic
Tail	Compressed	Rounded
Belly Scales	Broad, extends across entire width of the body	Small and never extends across the body
Back Scales	Enlarged	Not enlarged
Head Scales	Usually smaller, when larger it possess special features like a pit, supra labial scale, infra labial shield	Usually larger with no special features
Teeth	Upper jaw has a pair of teeth modified into fangs that are grooved	All teeth are uniform and small in size
Bite Marks	Usually two	More than two
Habit	Mostly nocturnal	Not nocturnal

VENOM CHARACTERISTICS:

SNAKE	Fatal dose	Average dose delivered per bite	Average fatal period
INDIAN COBRA	12mg	0.2g	8hours
COMMON KRAIT	6mg	0.22g	18hours
RUSSELL VIPER	15mg	0.15g	3days
SAW SCALED VIPER	8mg	0.13g	41days

GENERAL FACTS ABOUT SNAKES

Snakes are cold blooded animals without tympanic membrane. They react to vibrations received through the surface on which they rest rather than air borne vibrations. Snakes do not have a distinct visual system and they do not readily associate stationary objects with danger. Their sense of smell is the most important. Most land snakes feed on mice, rats and frogs. Krait and cobras are exceptional in being mainly snake eaters[1]. The life span of snakes in the wild has not been established. Longevity of some Indian snakes kept in zoos and by individuals include Indian python - 34 years, banded kraits - 11 years, Indian cobra - 21 years, saw scaled viper - 10 years.

EPIDEMIOLOGICAL FEATURES OF SNAKE BITE:

Documented reports of epidemiological studies of snake bite in India are few. Although the exact number of persons inflicted by snake bite is not known, it is estimated that about 2,00,000 persons are annually bitten by snakes in the country and 15,000 of these are fatal.[6] In a study conducted in Tamilnadu, hospitals records showed a mortality of 11.6 %. According to study by sawai in 1974, 71 % of the victims are found in the age group of 11 - 50 years and 75 % victims are males.[7] A Safdarjung hospital study showed 81.5 % of victims to be field workers. 75 % bite occurred outdoors, 88.6% of victims

were from rural india. Incidence of snake bite in India shows a seasonal variation. In north India 70-80% of bites are seen in the warmer months may be October 6, while a study conducted in Calicut Medical college, Kerala showed a maximum incidence in winter months (oct-jan) with the incidence of complications also maximum during this period.[8] Saiwas study in 1974 showed 68% of snake bites occurred in the evening and night, 32% in the morning and afternoon, 72% of bites were on the lower limbs, 25% on the hand and arm and 3% were on the trunk.

VENOM APPARATUS AND COMPOSITION:

In certain snake the paired salivary gland has assumed a very significant function (venom apparatus).[6] They secrete venom, a powerful multipurpose enzyme fluid through the channeled or grooved teeth, the fangs. Venom can be injected from the bottom of the fang (viper) or by an opening at the anterior aspect of the fang, a few millimeters above the tip.[4] Palestine vipers in catching their prey inject lethal doses of venom at each of ten or more consecutive strikes. When snakes have bitten two or more humans in rapid succession, the second or third victims were sometimes more envenomed than the first. However Russell vipers appear to inject most of their available venom at first strike. 50 % of Malayan pit viper bite showed little or no envenoming.

This suggests that some snakes might be capable of biting defensively without injecting venom.

Snake venom is a complex fluid with powerful ingredients that act to immobilize its prey. Venom is transparent, yellowish, slightly viscous and acidic. It is extremely heterogeneous containing about 15 enzymes and 10 non enzymatic proteins and peptides and atleast a dozen of other substance.[6] Various components of the snake venom have been mentioned in the accompanying table. Deoras in 1965 reported the lethal dose of venom common Indian poisonous snake to be cobra - 0.12 g, Russell viper - 0.15 g and echis carinatus - 0.08 g.[9] Variations in venom composition from species to species explains the varied clinical presentation of snake bite.

Hyaluronidase is present in almost all snake venom. It hydrolyzes the hyaluronic acid in interstitial spaces of the cells and connective tissue allowing further penetration venom into the surrounding tissues.[6] Protease in viper venom activates the mammalian clotting cascade by activation of factor IX or X. Ecarin a zinc metalloprotein activates prothrombin.[4]

Phospholipase A_2 the extensively studied of all venom constituents has damaging effects on RBC, platelets, leucocytes, skeletal muscle, endothelium, presynaptic terminals and also has opiate like sedative effects.[4]

Polypeptides called neurotoxins also cause presynaptic inhibition by blocking acetylcholine release or post synaptic inhibition blocking its action.[4] Hemorrhagins cause disruption of basement membrane of vessels and cause bleeding into organs.[6]

Actions of Snake Venom

S. NO.	ENZYMES	ACTIONS
1	Acetylcholine esterase	Catalysis and hydrolysis of acetylcholine
2	Arginine ester hydrolase	Bradykinin release, interfere with clotting
3	Hyaluronidase A	Reduction of collagen viscosity
4	Phospholipase A	Uncoupling of oxidative phosphorylation
5	Phospholipase B	Hydrolysis of lysophosphatides
6	Phosphodiesterase	Inhibition of arabinose derivatives, DNA and RNA
7	5' nucleotidase	Specific hydrolysis of PO4 monoesterase which links with 5; position of DNA and RNA
8	L amino acid Oxidase	Catalysis of amino acid
9	Thrombin like enzymes	Depression of fibrinogen levels
10	Proteolytic enzymes	Tissue destruction and bleeding
11	Collagenases	Collagen digestion

PRINCIPAL FEATURES OF ENVENOMATION BY DIFFERENT FAMILIES OF SNAKES

Elapidea (krait, cobra) principal manifestation is neurotoxicity. Local blisters and necrosis can occur. Australian elapides cause bleeding manifestation.[4]

Viperidae (russell viper, saw scaled viper) – local swelling, cellulitis, regional lymphadenitis and bleeding manifestations.

Hydrophidae (sea snake) – rhabdomyolysis.

Colubridae - bleeding manifestation and renal failure.[4]

CLINICAL FEATURES:

1. **LOCAL EFFECTS.**
2. **SYSTEMIC EFFECTS.**
3. **COMPLICATIONS.**

LOCAL EFFECTS:

The limb bitten by the snake shows increased vascular permeability leading to swelling and bruising. Factors responsible include proteases, phospholipases, hyaluronidase and endogenous autacoids released by the snake

venom like histamine and kinin. Venom of some vipers cause a diffuse increase in vascular permeability causing pulmonary edema.[4]. Local tissue necrosis occurs as a result of direct action of myotoxic and cytotoxic factors, ischemia due to thrombosis, external compression by tight tourniquets or swollen muscles.[4] Regional tender lymphadenitis is an important clinical sign, occurring early, and is toxin mediated. Local swelling is valuable sign of viper bite to the extent that its absence excludes viper bite. Local swelling occurs rarely with the cobra bite, but is not seen with krait or sea snake bites.[9]

SYSTEMIC FEATURES:

FEAR AND EMOTIONAL REACTIONS:

Whether the snake is poisonous or non - poisonous, fright is a common symptom. Patient may appear semiconscious with cold, clammy skin, feeble pulse and rapid shallow breathing.[9]

BLEEDING AND CLOTTING DISTURBANCES:

These are commonly seen after viper bites. This is due to procoagulant activity leading to consumption coagulopathy, anticoagulant activity inhibiting coagulating factors or due to thrombocytopenia.[4] In the absence of trauma these

generally do not cause spontaneous bleeding. If it occurs it is usually attributed to direct actions of hemorrhagic toxins.[4] Commonest hemorrhagic manifestation seen in a study done by Virmani and Dutt in Jammu was hematuria while for Reid it was hemoptysis. Other common types of bleeding include hemetemesis and bleeding from gums, injection sites, and nose.[10] Discoid ecchymoses have been noted by Reid in his studies. A few Australian land snakes can cause hemolysis.[4]

NEUROLOGICAL DISTURBANCES:

Neurotoxic polypeptides and phospholipases of snake venom cause paralysis by blocking transmission at neuromuscular junctions (post synaptic for cobra, responds to neostigmine, pre synaptic for krait, no response to neostigmine).[4] This is characteristics of kraits, cobras and coral snakes.

Early features would be prominent forehead wrinkles, then ptosis, external ophthalmoplegia and finally paralysis of bulbar muscles causing respiratory paralysis.[4] Some patients bitten by elapids or vipers are in a physiologically drowsy state in the absence of respiratory or circulatory failure probably due to release and binding of endogenous opiates.[4]

The ischemic lesions are more common in snake bite. The probable mechanisms are vasoconstriction and caused by venom or microthrombi formation as a result of coagulopathy and hypotension. Viper bites have been associated rarely with cerebrovascular accidents, most commonly due to hemorrhagic infarct and rarely due to ischemic infarct.

Viper bite is the most common snake bite in the Indian subcontinent. The envenomation by viper bite commonly presents with local envenomation, followed by abnormal coagulation. The various toxins present in the viper venom have both pro- coagulant and anticoagulant effect. The toxins are with well – established pro-coagulant / platelet aggregating properties.[11]

Following viper bite patients are also at risk of disseminated Intravascular coagulation and hypotension. Disseminated intravascular coagulation can cause of neurological disorder as a result of large vessel occlusion. The toxin itself can cause vasospasm which can precipitate a cerebrovascular accident. All the case reports of infarct following snake bite is due to viper bite. All these patients had features of local envenomation and most had evidence of disseminated intravascular coagulation. The infarct commonly involved the anterior circulation, with hemiparesis being the most common presentation. Study by Thomas, et al showed that administration of the anti-

snake venom within six hours of the viper bite, would prevent this complication.

CARDIAC MANIFESTATION:

Electrocardiographic abnormalities following snake bite may be due to direct cardiotoxic action of venom, hypotension or electrolyte disturbances.[12] Present in cobra venom cardiotoxin inhibits direct and indirect stimulation of skeletal muscle, decrease the acetylcholine release at the nerve endings and blocks axon conduction . Some effects of cardiotoxin resemble those of digitalis in that it can cause cardiac arrest in systole.

However, Agarwal et al, in are prospective series of 55 patients with severe neurotoxic snake envenoming secondary to elapid snake bites, found no clinically significant cardiac involvement. Tachycardia and bradycardia in this study may be due to autonomic nervous system dysfunction where tachycardia occurred due to sympathetic stimulation as a result of severe fear and bradycardia occurred due to parasympathetic stimulation, also as a result of severe fear.

Possible mechanisms are disseminated intravascular coagulation causing thrombus formation in coronaries and direct vasculitis by snake venom causing

an infarction. Some snakes have sarafotoxins, which cause coronary vasoconstriction. Coronary spasm due to endothelins released by snake bite is also considered to be a possible mechanism.

Other mechanisms that suggested has causative for myocardial infarction (MI) for viper bite are,

(1). Hypovolemic shock due to bleeding

(2). Anaphylactic shock

(3). Hypercoagulability in consumption coagulopathy

(4). Hyperviscosity secondary to hypovolemia induced hemoconcentration

(5). Direct cardiotoxic effect on myocardium.

Tony and Bhat et al, have reported a case of MI on day 2 following a snake bite and proposed vasospasm caused by Viper snake venom is a complex toxin with rich components affecting hemostatic mechanisms. Most of the viper venom exhibit both anticoagulant and coagulant effects. Toxic vasculitis caused by certain viper species may result in thrombosis.

Common ECG findings[12] are,

1) Sinus bradycardia.
2) Sinus tachycardia.
3) Sinus arrhythmia.

4) Tall T waves.
5) ST depression of 1 mm with flat or inverted T waves in all chest leads or in anterior and / or inferior leads.
6) ST elevation in lead V_1 to V_6, I, aVL, Q wave in V_1 to V_4 and ST depression in II, III, aVF.
7) First degree or second degree AV block.

RHABDOMYOLYSIS:

Generalized rhabdomyolysis with release of myoglobin, muscle enzymes and potassium cause respiratory failure, hyperkalemia and occasionally renal failure (mainly seen in sea snakes).[4]

COMPLICATIONS:

HYPOTENSION / SHOCK:

- Pain shock due to vasovagal mechanisms.
- Vasodilating autacoids and oligopeptides in viper venom inhibit the kininase enzyme leading to vasodilating and shock.
- Life threatening anaphylactic reactions in previously sensitized individuals within minutes of being bitten.
- Hypovolemia.

- Pulmonary intravascular clotting due to procoagulant effect can cause features of pulmonary infarction and shock.
- Direct myocardial action of toxin can contribute to hypotension.
- Pulmonary edema due to multiple effects also contributes to Shock.

ACUTE KIDNEY INJURY

PATHOGENESIS:

The exact mechanism is not well known due to lack of animal model. The factors contributes are direct cytotoxicity, bleeding, intravascular hemolysis, DIC, MAHA.

Direct nephrotoxicity:

Experimental studies shows excretion of venom from urine without damage to kidneys. Venom of Russell viper has direct toxic effect on kidneys.[14] In a study administration of russell's viper venom in rhesus monkeys cause hemorrhage in their kidneys and mild ATN within 24 hours. The histological changes are similar to the human victims.

The strongest evidence is dose dependent decrease in inulin clearance and increase in excretion of sodium. However the study does not includes morphological analysis of the perfused kidneys. Willinger et al, studied the combined functional and morphological kidney changes after russell's viper venom administration. It induced changes in renal plasma flow, GFR, filtration fraction. The excretion of sodium is increased. Both oliguric and polyuric phases observed. The most prominent morphological changes observed in renal cortex. Extensive damage of the glomerular epithelial cells observed.

The venom leads to complete lysis of vascular smooth muscle cells leaving behind only the basement membrane. Varying degrees of epithelial injuries occur in all tubular segments. In addition myoglobinuria, sepsis, and hypersensitivity to venomous or anti – venomous protein may also contribute to renal failure. Myoglobinuria generally occurs following sea snake envenomation, results in necrosis of striated muscles and muscular paralysis.

Intravascular Hemolysis:

It is the another factor thought to have pathogenic significance. It is due to the action of phospholipase A_2 which is present in almost all snake venoms and a basic protein called "direct lytic factor" found only in elapid

venoms. It causes direct hydrolysis of RBC membrane phospholipids or by production of hemolytic lysolecithin. Anemia, jaundice, reticulocytosis, abnormal smear present in 50 % of patients with hemolysis.

Some studies have even suggested that AKI following snake bite is an example of HUS. However microangiopathic hemolysis as seen in HUS is observed rarely. More than 70 % patients with snake bite induced AKI shows only ATN and do not exhibit glomerular and arteriolar changes as seen in HUS.

Glomerular lesions:

Whether or not specific glomerular lesions really occur is controversial. Sant and Purandare et al, reported a case of "proliferative glomerulonephritis" in elapidae bites. Later Seedat et al, reported two cases of crescentic glomerulonephritis, following puff adder bites, presenting as AKI. These workers ascribed these lesion to an allergic reaction to snake venom. Sitprija and boonpucknavig described two patients wuth crescentic glomerulonephritis following Russell's viper bite.

HEMORRHAGIC AND BLOOD COAGULATION DISTURBING ACTION OF SNAKE VENOM

PATHOGENESIS OF SNAKE BITE HEMORRHAGE

The pathogenesis of snake bite hemorrhage involves coagulation disturbances by venom anticoagulants, thrombocytopenia and vessel wall damage caused by venom hemorrhages.

INVIVO ACTION:

DISSEMINATED INTRAVASCULAR COAGULATION:

Incoagulability of blood in animals dying from viper bite was mentioned in eighteenth century by Geoffrey (1737) and Fontana (1767). It is now generally accepted that the incoagulability produced by venom is primarily due to intravascular coagulation. The mechanism of induction of intravascular clot varies with different species. As already discussed above, it occurs mainly by the direct conversion of fibrinogen to fibrin or prothrombin to thrombin or factor X to XII activation by the venom.[15] Direct pathological evidence for intravascular clotting in humans is a demonstration of intravascular clot. But their absence on autopsy does not rule out disseminated intravascular coagulation as fibrinolysis can occur in the postmortem period. So the

demonstration of a clot depends on the time between venom injection, dose of venom and the time of autopsy.[14]

PRIMARY FIBRINOLYSIS:

In some cases it was found that when the blood was left to stand in a test tube for some time it resulted in formation of a clot which then lysed after few minutes. This led on to the study of any other mechanism other than disseminated intravascular coagulation being responsible for bleeding abnormality. A suggested mechanism was the direct fibrinogenolytic activity of venom.

The importance of knowing whether primary fibrinolysis acts in a significant manner in snake bite coagulation disturbances is of practical therapeutic importance. In case the coagulation disturbance is primarily DIC early stages would be benefitted by heparin therapy (while in case of primary fibrinolysis the condition will be worsened by heparin). The points used for differentiation between primary fibrinolysis and DIC are listed in the accompanying table.

INACTIVATION OF FIBRIN STABILISING FACTOR:

Though in vitro activation of fibrin stabilizing factor Echis Coloratus has been demonstrated, in vivo inactivation is mainly a consequence of intravascular clotting.[16]

THROMBOCYTOPENIA:

It is known to accompany clinical and experimental defibrination. Apart from the fact that the platelets are trapped in intravascular clots venom factors (possibly phosapholipase A) contribute to platelet damage. Clinically even in those cases in which thrombocytopenia is a feature, the hemorrhage of snake bite lacks the characteristics of thrombocytopenia in that petechiae are absent. It is now concluded that thrombocytopenia is not the primary cause of envenomation hemorrhage, but may be a aggravating factor**.**[16]

HEMORRHAGINS:

In coagulability without hemorrhage was observed both clinically and experimentally in a few cases.[14,16] This led to the assumption that hemorrhage in snake also occurs due to mechanisms other than coagulaton disturbnce. This led to the discovery of the vessel wall damaging factor termed hemorrhagin in

the snake venom.[17] Earlier studies by Flexner found that these toxins cause rents in the vessel wall.[18] It was concluded red blood cells spurt through pores developing in the region of the inter endothelial substance.

SUPPRESSION OF FIBRINOGEN FORMATION:

Snake venom is said to inhibit fibrinogen formation in the liver but this is not well established.

COMPARTMENT SYNDROME:

This is a condition in which an increase in tissue pressure within a closed space impedes, the blood supply and functioning of the tissue within that space.[15]

In viper bite swelling of muscles within tight fascial compartment may raise the tissue pressure to such an extent that perfusion is impaired and ischemic damage is added to the effects of the venom.[13]

GENERAL CLINICAL FEATURES OF COMPARTMENT SYNDROME:

1. Pain disproportionate to the primary diagnosis

2. Pain worsened by the passive stretch of the affected muscles.

3. Pressure palpable over the compartment.

4. Paresis of affected muscles.

5. Parasthesia in the distribution of the affected nerves.

6. Pallor.

7. Pulseless in the most severe cases.

GUIDELINES FOR THE INTREPRETATION OF TISSUE PRESSURE MEASUREMENTS IN NORMOTENSIVE AND HYPOTENSIVE PATIENTS

Tissue pressures less than 20 mm Hg are essentially normal. Pressure between 20 and 30 mm Hg require careful follow up and serial pressure measurements. Compartment pressures greater than 30 mm Hg suggest the need for immediate fasciotomy. Hypotensive patients may develop compartment syndrome at lower tissue pressures and fasciotomy should be considered when the compartment pressure is within 10 to 30 mm Hg of the diastolic blood pressure (Whiteside and associates 1875) Medical therapy, including vasodilating

drugs and sympathetic blocking agents, is not effective in the treatment of acute compartment syndrome (Christenson. JT, wulff K 1985, Hutchinson, MR Ireland ML, 1994).

MANAGEMENT

General Measures

DO IT R.I.G.H.T protocol

- **R**eassure the victim[4]
- **I**mmobilize the bitten limb using a splint or sling as muscular
- **G**et to **H**ospital immediately
- **T**ell the doctor about symptoms
- Cauterization, incision and drainage, amputation, usage of venom pumps, instillation of chemical compounds and electric shock locally are all to be avoided as these will cause uncontrolled bleeding from the site and damage of nerves and vessels, leading to necrosis.[4]
- Use of tourniquets are controversial, dangers of their application include ischemia and gangrene, damage to peripheral nerves and increased local effect of venom. But in case of cobra or sea snake if medical therapy is likely to be delayed a firm crepe bandage can be applied
- Inj. Tetanus toxoid should be given.

SPECIFIC THERAPY

Antisnake Venom Therapy

INDICATIONS:

Distinction of poisonous from non-poisonous snake is often difficult and is not usually important for the clinician. It is known that about 15 drops of viper venom can be fatal to an adult and 3 drops of cobra venom could be lethal and one drop of sea snake venom could kill 5 men. Fortunately, human bite is defensive reaction which rarely results in much of venom being injection. Following poisonous snake bite more than half of victims will have minimal or no poisoning and only a quarter will develop systemic poisoning. Hence poisonous snake bite is not synonymous with snake bite poisoning. So even though the snake is identified as poisonous or there are bite marks, treatment should be given only if there are signs of envenomation. Anti snakevenom itself can be fatal and it is costly drug with limited supply.[9]

CLINICAL INDICATIONS:

- Hemostatic abnormalities
- Neurotoxicity
- Generalized rhabdomyolysis
- Definite of local envenomation

CONTRAINDICATIONS:

There is no definite contraindication as Antisnake venomes the only specific therapy for snake bite. Atopic patients and those who had reaction to equine antiserum on previous occasions have an increased risk of developing server antivenom reactions. It can be ameliorated by pre-treatment with adrenaline, anti-histamine and corticosteroids.[4]

TYPES OF ANTISNAKE VENOM

Mono-specific forms are more effective and less likely to cause reactions than polyspecific antivenom. In most developing countries only single polyspecific antivenom is available.[20] In India ASV is produced by Haffkine Institute, Bombay and Central Research Institute, Kasauli. It is produced by hyper immunizing horses against the common four poisonous snakes (Cobra, Krait, Russell's and Saw scaled viper).[1]

MANUFACTURING AREAS OF ASV

PUBLIC SECTOR	PRIVATE SECTOR
Central Research Institute (CRI), Shimla hills, Kasauli HP	VINS bioproducts Ltd, Hyderabad
King's institute of preventive medicine, Chennai	Biological E Ltd, Hyderabad
Haffkine biopharmaceutical company Ltd. Mumbai	Bharat serum and vaccine limited
Bengal chemical and pharmaceutical limited, Kolkata	Serum institute of India limited, Pune

DOSE OF ANTI-VENOM

The dose schedule for the polyvalent and monovalent antisnake venom varies. We know the lethal dose of Cobra is 0.12g, krait 0.06g, Russell Viper – 0.15 g, Echiscarinatus – 0.08 g.[6] Polyvalent anti-snake venom 1 ml neutralizes 0.6 mg of cobra venom, 0.45 mg of Krait, 0.6 mg Russell viper and

0.45 mg of Saw Scaled viper venom. Based on this if the poisonous snake is known, dose of antisnake venom can be estimated theoretically. But practically it is not applicable as amount of venom injected in each patient varies and invitro studies do not correlate with in vivo results. Bases on the results of a number of studies the dose of antisnake venom conventionally recommended as initial dose if snake is know is common krait - 100 ml of haffkine polyspecific antivenom, Russel viper - 100ml, Indian Cobra – 100 ml and Echis Carinatus – 100 ml. If the snake is not known the recommended amount of anti snake venom given based on clinical signs is 50 ml, 100 ml and 150 ml for grades I and III. For patients, presenting with neurotoxic features initial dose of ASV given is 100 ml.[21]

The apparent serum half-life of antisnake venom in envenomated patients ranges from 26 to 95 hours depending on how they are prepared. Though it clears the venom from the circulation immediately, the clinical effect on clotting restoration occurs usually after four hours. Thus if dose has been adequate clotting time should be normal by 6 hours.[4,22] Neurotoxic sings improve within 30 minutes but may take several hours. A second dose is given if neurological features persist for more than 30 minutes. Dose of ASV is the same for adults and children.[4]

There is controversy about how long after envenomation Anti-venom therapy is still effective. Carrison et al, claim that it is most useful if given within 4 hours, less delayed for 8 hours, and doubtful if after 24 hrs.[23] However, Dwivedi et al, have reported therapy with Anti-snake venom to be beneficial even after 8 days and state that there is no fixed time limit.[24]

MODE OF ADMINISTRATION

Local Injection:

If it is possible to inject anti-venom locally at the site of bite with in a few minutes, necrosis might well be prevented. But in practice this is virtually never possible and therefore is not advocated.

Intravenous Injection

It is the most effective route. An infusion of anti-snake venom mixed with isotonic fluid is given in 1:3 dilutions. It is given over 30 - 60 minutes, initially starting with 10 - 15 drops / min and then increasing the dose.[4] ASV can also be given direct intravenous push. Its been found there is no difference in reaction between the two methods.[25]

ANTIVENOM REACTIONS AND TEST DOSE:

Antivenom therapy is complicated by three types of reactions.

1. Anaphylactic (early)

2. Pyrogenic.

3. Late serum sickness type of reaction.

EARLY ANAPHYLACTIC REACTIONS:

It was initially thought to be Ig E mediated. But complement activation by IgG aggregates or residual Fc fragments or direct stimulation of mast cells or basophils by antivenom protein are the more likely mechanisms. However, in most there is no prior exposure the serum. Skin test dose reactions do not correlate with the incidence of reactions occurred during ASV administration.[4,21] Complement activation is also implicated, but not proved.[21] Clinical features include itching, utricaria, fever, tachycardia, palpitations, nausea, vomiting. Minority may develop severe hypotension, bronchospasm and angioedema. Early reactions are managed by 0.5 ml of 0.1 % adrenaline subcutaneous and chlorpheneramine maleate 10 mg IV.[4]

PYROGENIC (ENDOTOXIC) REACTIONS:

It results from contamination of antisnake venom endotoxin like compounds. Develops after 1 - 2 hours after treatment. Symptoms include fever, vasodilatation and fall in Blood Pressure. High fever occurs which is treated with paracetamol.[4]

LATE (SERUM SICKNESS TYPE) REACTION:

It develops 5 - 24 days later, characterized by fever, itching, urticaria, arthralgia and lymphadenopathy, mononeuritis multiplex, proteinuria with immune complex nephritis and rarely encephalopathy. It is treated with chlorpheniramine 2 mg four times daily or prednisolone 5 mg four times daily for 5 days.[4]

The rule of the intradermal test with 0.2 ml of ASV, though widely followed is controversial. According to some authors, this test only delays the onset of definite therapy and has no role in the prediction of early or late anti snake venom reactions.[4,25]

OTHER SUPPORTIVE MEASURES:

Neurotoxic Effects - Artificial Ventilation:

Intravenous neostigmine 0.5 mg given at half hourly interval for five injections. This is followed by same dose at increasing intervals of 2 to 12 hours, according to neurological recovery. Each dose of neostigmine is preceded by 0.5 mg atropine.[6]

SHOCK – plasma expanders, dopamine infusion, steroids are used.

RENAL FAILURE:

During initial oliguric phase (less than 400 ml / 24 hours) dopamine infusion at the rate of 2.5 mg / kg / min or diuretics are used. In established renal failure, dialysis is indicated.[4]

LOCAL INFECTION:

Intra compartmental syndrome - broad spectrum antibiotics are used. Blisters are best left undisturbed. Slough should be excised. Swelling of muscles within tight fascial compartment may raise the pressure leading to impaired perfusion and ischemia. In these circumstances fasciotomy is indicated. It should be done only after blood coagulopathy has been treated.

Steroids are advocated in both patients presenting with bleeding tendencies and with neurological manifestations (hydrocortisone 50 to 100 mg i.v 8th hourly). However, its use remains controversial.[24]

HEPARIN:

Some studies showed that if heparin 10, 000 units is given intravenous stat followed by 5000 units 8th hourly i.v and continued for 4 hours is useful in the prevention of DVT. Yet other have shown that it is ineffective and worsens bleeding.[18]

FIBRINOGENS INFUSIONS are not helpful[14]

BLOOD TRANSFUSION:

It helps in viper bite shock secondary to bleeding and also in the management if specific antivenom is not available.

PREVENTION OF SNAKEBITE

Snakes have adapted to a wide range of habitats and prey species. All snakes are predatory carnivores, none are vegetarians although some eat eggs. Since snakes are preyed upon by other animals, they tend to be secretive and have evolved many survival strategies. By understanding something about snakes habits, simple precautions can be adopted to reduce the chance of encounters and subsequent bites. Some truths apply to all snakes, they prefer not to confront large animals (such as humans). Thus, it is best so give them the chance or time to slither away. Some species are mainly nocturnal hunters, and other species are mainly diurnal hunters. Many snakes are non-venomous, while others are only mildly venomous and not particularly dangerous to humans. However, a few are highly venomous and their bites are potentially lethal. Snakes are necessary for maintaining a healthy balance in nature, they should not be killed unnecessarily. It is important that everyone learn which dangerous snakes occur in the local community or area.

- **In the house**, where snakes may enter in search of food or to find a hiding place for a short time.

- Do not keep livestock, especially chickens, in the house, as some snakes will come to hunt them.

- Store food in rat-proof containers.

- Raise beds above floor level and use an insecticide impregnated mosquito net, completely tucked in under the sleeping mat. This guards against centipedes, scorpions, and snakes as well as malaria mosquitoes and many ectoparasites (fleas, lice, bed bugs etc) (Chappuis et al, 2007).

- **In the farmyard, compound, or garden** try not to provide hiding places for snakes.

- Use a light and wear proper shoes when walking outside at night.

- Clear heaps of rubbish, building materials and other refuse from near the house.

- Do not have tree branches touching the house.

- Keep grass short or ground clear around your house and clear underneath low bushes so that snakes cannot hide close to the house.

- Keep your granary away from the house (it may attract animals that snakes will hunt). Water sources, reservoirs and ponds may also attract animals of prey.

- Listen to wild and domestic animals, they often warn of a snake nearby.

- **In the bush or countryside**, firewood collection at night is a real danger.

- Watch where you walk. Step on to rocks or logs rather than straight over them as snakes may be sunning themselves on the other side.

- Do not put hands into holes, nests or any hiding places where snakes might be resting.

- Wild animals, especially birds, may warn of snakes nearby.

- Be careful when handling dead or apparently dead snakes even an accidental scratch from the fang of a snake's severed head may inject venom. Some species such as the rinkhal (*Hemachatus haemachatus)* may sham death as a defensive tactic.

- Many snakebites occur during ploughing, planting and harvesting and in the rainy season. Rain may wash snakes and debris to the edges of roads, and flush some species such as burrowing asps (*Atractaspis*) out of their burrows Pedestrians should be careful when walking on roads after heavy rain especially after dark.

- Drivers or cyclists should never intentionally run snakes over on the road. The snake may not be instantly killed and may lie injured and pose a risk to pedestrians and other cyclists. The snake may also be injured and trapped under the vehicle, from where it will crawl out once the vehicle has stopped or has been parked in a compound or garage.[40]

Essential Medicines and Supplies for Managing Snakebite at a District Hospital

In order for health workers to deal effectively with cases of snakebite, it is important that certain essential supplies are available in their health facilities and that they are trained in the best methods for using them. Below is a list of recommended essential supplies for the management of snakebite. It can be modified to suit the needs of local health workers, depending on their specific training and aptitude in dealing with snakebite victims.

1. Antivenom (with sterile water for reconstituting lyophilized antivenom)
2. Tetanus toxoid
3. Epinephrine (adrenaline) injection 0.1 % (1:1,000) (1 mg/ml)
4. Parenteral antihistamine and hydrocortisone
5. Pain killers e.g. paracetamol and codeine

NOT aspirin or nonsteroidal anti-inflammatory agents

6. Antipyretics (paracetamol tablets, syrups and suppositories)
7. Local anaesthetic agents (1 - 2 % lidocaine)
8. Intravenous (IV) fluids e.g. normal saline (0.9 % NaCl)
9. Vasopressor drug e.g. phenylephrine, adrenaline and nonadrenaline
10. Atropine and edrophonium or neostigmine (Prostigmin) for "Tension Test"

11. Fresh frozen plasma or cryoprecipitates
12. Blood platelets
13. Oxygen cylinders with spanners, gauges, necessary connectors
14. Antibiotics (chloramphenicol, benzylpenicillin, flucloxacillin, metronidazole, gentamicin, amoxicillin-clavulanic acid)
15. Laryngoscope (adult and paediatric sizes) with spare batteries and bulbs
16. Cuffed endotracheal tubes (various sizes)
17. Ambu bag with connectors to endotracheal tube and face mask that fit
18. Face masks and oral airways
19. Suction apparatus and catheters
20. Urine dip sticks
21. New, clean, dry glass vessels for 20WBCT
22. Syringes, needles, intravenous cannula
23. IV administration set
24. Sticking plaster
25. Scissors
26. Splints
27. Urethral catheters
28. Bathroom type weighing scales
29. Stretchy, elasticated crepe bandage and splint.[40]

Immediate Measures after snake bite:

Capture snake	**NO**
Incise fang marks	**NO**
Oral suction	**NO**
Ice	**NO**
Tourniquet	**NO**
Constriction band	**NO**
Splint and sling	**NO**
Electric shock to denature venom	**NO**
Rapid transport	**YES**
Start I.V line	**YES**
Emergency medical services	**YES**

MATERIALS AND METHODS

STUDY POPULATION

Hundred patients with the history of snake bite admitted in Thanjavur Medical College Hospital during the period Jan 2016 to May 2016 was taken up for this study.

SELECTION CRITERIA

Patients presenting with the history of snakebite with or without evidence were taken up for the study. Patient with the history and definitive evidence of snakebite in the form of local cellulitis, regional lymph adenitis, and / or prolonged clotting time, taken as suggestive of bite were considered under venomous group.

Patient with neurotoxic manifestation like Ptosis, dysphagia external ophthalmoplegia were also included in the study under venomous group. Patient with the history of unknown bite, with or without local swelling with normal clotting time were categorized under non venomous group and included in the study.

Patients having local swelling due to tourniquet application and local native treatment were also considered for the study.

Study population is divided according to severity into four grades

GRADE I	**GRADE II**
History of snake bite With or without cellulitis Normal clotting time	Local cellulitis Regional lymphadenitis Normal clotting time
GRADE III	**GRADE IV**
Prolonged clotting time With or without local features	Local features Prolonged clotting time With systemic bleeding

EPIDEMIOLOGICAL DATA

1. The age and sex incidence of snake bite
2. Age group affected
3. Occupational incidence
4. Outdoor and indoor incidence
5. Urban and rural incidence
6. Seasonal incidence
7. Diurnal incidence
8. Body site of bite
9. Type of snake bite

CLINICAL MANAGEMENT DATA

1. Average number of anti snake venom vial used
2. Complication encountered including that of antivenom administration
3. Number of venomous bite cases gone in for renal failure
4. Incidence of venomous bite cases gone in for neuroparalysis
5. Number of venomous bite cases gone in for coagulation failure
6. Incidence of venomous bite case of gone in for compartment syndrome

The following basic investigations for all the cases were done.

Total Leukocyte count – using Turke's fluid

Normal value : 4,000 to 11,000 cells / cu.mm of blood

Differential counts – using Leishman's stain

Normal value :

Polymorpho nuclear neutrophils – 62.0%

Polymorpho nuclear eosinophils – 2.3%

Polymorpho nuclear basophils – 0.4%

Monocytes - 5.3%

Lymphocytes - 30.0%

Red blood cell count – using Hayem's diluting fluid

Normal value :

Men : 5.2 millions / cu. mm of blood

Women : 4.7 millions / cu. mm of blood

PLATELET COUNT

The stain used was brilliant cresyl blue prepared by mixing 0.3 gms percentage of brilliant cresyl blue crystals with one drop of formalin and 100ml of distilled water. Using a RBC pipette blood was taken upto the 0.5 reading and brilliant cresyl blue fluid (1 in 200 dilution) till the 101 mark. It was left 2 minutes and then charged with a cover slip into a Neubar chamber. Platelets were seen a bluish pink spots. Normal range 1.5 – 3 lakhs / cu. mm.

URINE:

Albumin - Heat and acetic acid test

Sugar – Benedicts test

Deposits – sediment of the centrifuged urine seen through microscope

Urine albumin : Normal value – Negative

Urine myoglobin:

Method:

Qualitative test of myoglobin by blond Herim 1958. T0 5ml of urine add 2.8 gm of Ammonium sulphate, dissolved by mixing. The urine is 80 % saturated with Ammonium Sulphate. This is optimal for the precipitation of the

Hemoglobin. Then filter and centrifuge. If supernatant shows normal color the precipitated protein is Hemoglobin. If the supernatant protein is colored that is due to myoglobin.

Urine Sugar : Normal value – Negative

Urine deposits:

Red cells and red cell casts:

Normal value of RBCs

1 to 2 / LPF (Low Power Field)

0 to 1 / hpf (high power field)

Red cells casts – Nil (zero) / LPF

White cells and white cell casts

Normal values:

RBCs – 0 to 5 / HPF

WBC Casts : none (zero) / LPF

Epithelial cells and epithelial casts

Normal values : Occasional Renal epithelial cell may be found.

HYALINE CASTS:

Normal value : Occasionally hyaline cast / LPF may be found.

GRANULAR CAST:

Normal value : Occasionally granular cast may be seen.

WAXY CASTS:

Never seen in healthy subjects.

OVAL FAT BODIES AND FATTY CASTS:

Never seen in healthy individuals.

Blood group - by slide agglutination method.

BLEEDING TIME:

Bleeding time was estimated by dukes method. Here, a needle prick was given on the tip of the finger, about one centimeter deep and the blood bleeded off. The time taken for bleeding to stop was noted.

Normal range - 3 to 5 minutes.

CLOTTING TIME:

Though there are various methods of assessing the clotting time (the normal by lee and white – 6 to 9 minutes, Dale and Laid - 3 to 5 minutes), the method selected for our study was that of Ulnas, for practical reasons. By this method 2ml of blood was kept undisturbed in a pyrexex test tube (10 cm tall and inside diameter 1 cm). After 5 minutes test tube was gently tilted to 45 degree and tested for clotting procedure was repeated every minute until the blood clotted. The normal clotting time by this method was in the range of 9 to 15 minutes. The sample was left behind to assess the clots quality.

PROTHROMBIN TIME:

Although originally thought that measure prothrombin time the test is now known to depend also on reactions with factors V, VII and X and fibrinogen concentration. Thus the name [prothrombin time is not accurate. This tests the effectiveness of extrinsic pathway. Test was done with both patient and control plasma, 0.1 ml of plasma in a glass tube was placed in a water bath at 37 degree for 3 to 5 minutes and 0.2 ml of liquiplastin reagent was added. Time taken for the sample to clot was noted. Normal values depend on the thromboplastin used. The normal is 10 - 14 seconds. Test is abnormal if prolonged by more than 2 seconds over the control value.[23]

Serum electrolytes – by flame photometry.

Normal values:

Serum sodium – 136 to 145 meq / L

Serum potassium - 3.5 to 5 meq / L

Serum cholesterol - Estimated by ZAK method. Normal 150 to 250 mgs.

Plasma fibrinogen levels:

Reagents used:

1. Ammonium sulphate – 13.3 of ammonium and 1 gm of sodium chloride in 100 ml of distilled water. pH is adjusted by adding 10 N NAOH.

2. Normal saline : 9 gms of sodium chloride in 1 liter of water.

TEST	**BLANK**
0.5 ml plasma and 0.5 ml normal to saline added to 9ml of ammonium sulphate solution	1 ml of normal saline added 9ml of Ammonium sulphate

Shake and read after 5 minutes

With 420 filter.

Result = test – blank = Blood. Fibrinogen in mgm % (Normal 200 – 400 mgm %)

THE FOLLOWING SPECIAL INVESTIGATIONS WERE DONE:

DUPLEX - B mode Doppler study was done.

DUPLEX DOPPLER:

These machines combine real time imaging with pulsed Doppler. This allows the operator to identify a specific segment in a particular vessel and to place a gate or sample volume, at a specific location so that the source of Doppler signal is none. The time taken by the pulses of ultrasound to travel to and from the blood vessels means that, for Deeper vessels the pulse repetition frequency is limited as the system wait for a pulse to return before transmitting the next pulse. This means that the magnitude of Doppler shifts which can be measured is limited and detection of higher shifts in deeper level may not be possible in certain circumstances. The Doppler information is transmitted as an audio signal and as a spectral display scrolling across the scene.

Vessels have different wave forms or Doppler signals which depends on the size of the blood vessel and type of the capillary bed it is supplying. The wave form characteristics can change significantly in response to physiological stimuli as shown by increased diastolic flow which is seen in the femoral arteries on exercising the leg muscles.

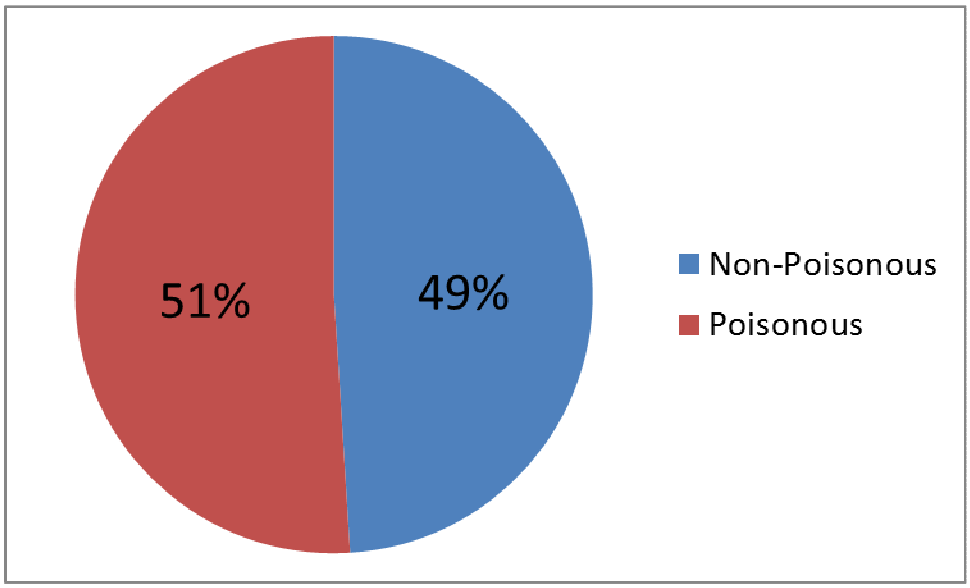
Compartment pressure study was done for 43 patients with cellulitis by "syringe manometer" technique. Tissue compartment pressure can be measured with minimal equipment available using the "syringe manometer" technique (Whitesides TE, Haney, TC, Morimoto, K et al, 1975).

ANALYSIS OF RESULTS

GENERAL FEATURES:

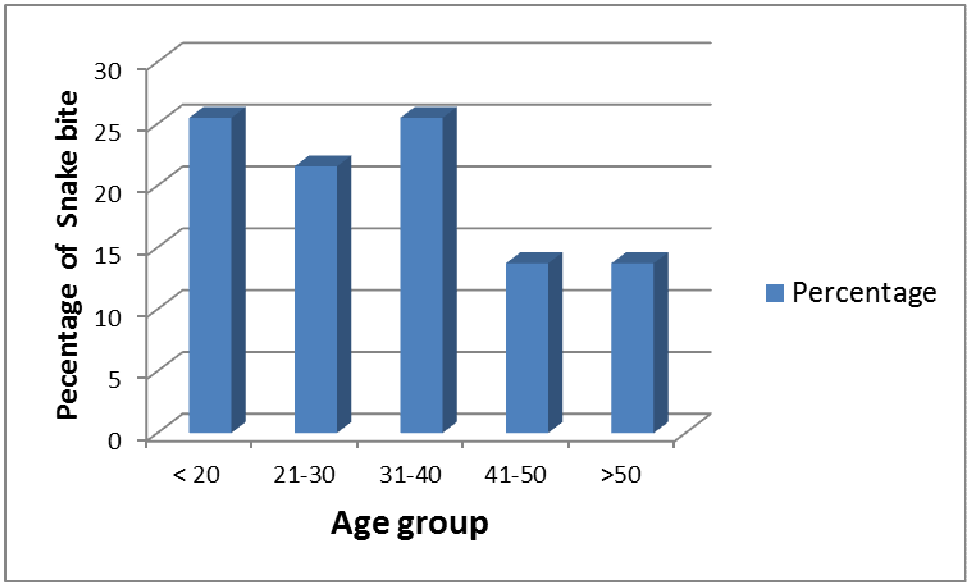
A total of 100 patients were admitted in Thanjavur Medical College Hospital general medical wards from January to May 2016 with either history or features suggestive of snake bite. Of the 100 patients with snake bite 43 had features suggestive of coagulation abnormality. Six patients presented primarily with neurotoxic manifestation. Two patients has hemostatic and neurotoxic abnormality. Rest of the 49 patients had no features suggestive of snake bite 51 % were poisonous and 49 % were nonpoisonous which is depicted in figure 1. Of the poisonous bite 84.32 % had primary coagulation abnormality and 11.76 % had neurotoxic manifestation and 3.92 % both.

Figure 1 : Distribution of Snake Bite



Out of the 51 patients admitted with features of envenomation were selected at random for the study. The average age of the patients in our study was 28 years ranging from 8 years to 70 years. Majority of snake bite occurs in 20 to 45 years which is depicted in figure 2.

Figure 2: Age Distribution of Snake bite



In this study among the poisonous snake bite males 74.51 % were bitten more than females 25.49 % which is depicted in table 1.

Table 1: Gender distribution

Gender	Total	Percentage
Males	38	74.51
Females	13	25.49

The study population was grouped into 4 categories grades I, II, III and IV according to clinical features and clotting time. Of which grade IV category not present in this study. 12 patients belonged to grade I, 27 to grade II and another 12 to grade III (23.53 %, 52.94 % and 23.53 %) respectively. These patients were subjected to various coagulation parameter assessment tests.

Table 2: Distribution of Species of Snake bite

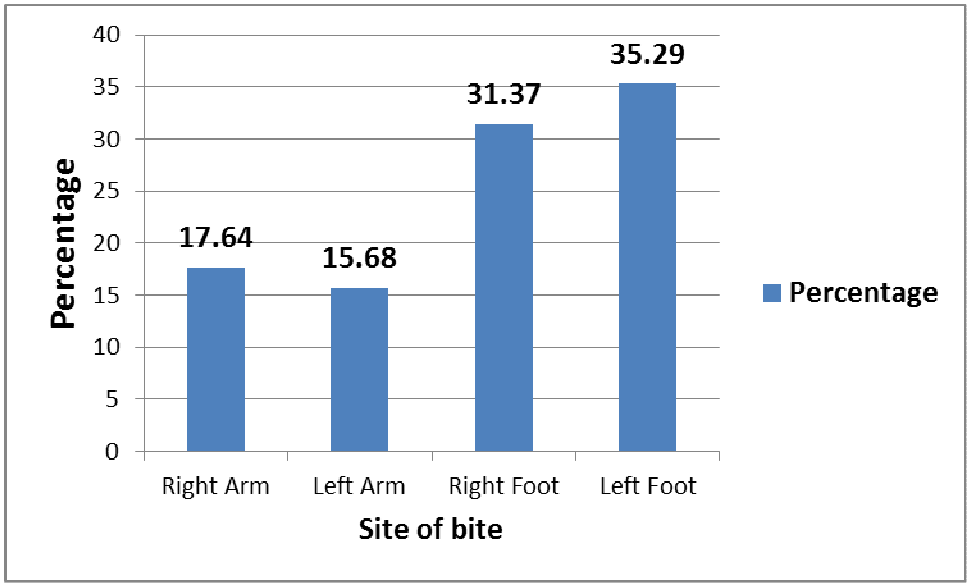
Type of Snake	**Total**	**Percentage**
Russel Viper	3	5.88
Saw scaled Viper	9	17.65
Krait	2	3.92
Unidentified	37	72.55

In this study majority of snake bite was unidentified (72.55%) species. After that Saw Scaled Viper (17.65%), Russel Viper (5.88%), Krait (3.92) which was illustrated in Table 2 .

Majority of the patients had bite on the lower limb 66.66 %. The incidence of bite in the upper limb was 33.34 % which was depicted in figure 3. The

average duration of hospital stay of the snake bitten individuals with clotting abnormality was 6 days, ranging from 2 to 28 days.

Figure 3 : Distribution of Site of snake bite



ASSESSMENT OF CHANGES IN COAGULATION PROFILE

Blood is taken at the time of admission before therapy was started in those having definite envenomation excluding neurotoxic manifestations.

CLOTTING TIME

Of the 51 patients, 72 % have prolonged clotting time at the time of admission. In 3 cases (6.25%) clotting time was normal during admission but turned abnormal in a period of 4-12 hours. In total 79 % have prolonged clotting time.

BLEEDING TIME

In all cases it was found to be normal even in cases who had bleeding manifestations. The average bleeding time was found to be 2 - 6 minutes.

PLATELET COUNT

Platelet count was found to be reduced in all cases belonging to both grades II and III. The average platelet count was 97,486 cells / cu.mm. Thus a 100% reduction was noted. The average count in grade I was 2.3 lakhs.

PROTHROMBIN TIME

This test is done primarily to evaluate any abnormality in extrinsic pathway. It was done in 11 out of 12 cases belonging to grade I (that is local

features with normal clotting time). The test was found to be normal in all. But one out of 12 cases who belonged to grade I with prolonged prothrombin time went to develop abnormal coagulation profile over a period of six hours..

In grade II, 20 out of 27 cases were evaluated for prothrombin time and in grade III, 9 out of 12 cases were tested. All these patients showed prolongation of prothrombin time denoting a 100 % positivity.

Table 3 : Laboratory Profile of Snake Bite

Laboratory Profile	Mean	Standard Deviation
Bleeding Time	3.74	1.56
Clotting Time	9.54	1.85
PT – INR	20.8	1.05
Urea	42	1.26
Creatinine	2.1	1.36

CORRELATION OF COAGULATION ABNORMALITY WITH THE TYPE OF SNAKE

In 12 out of 51 patients (23.53 %) the snake was killed and bought to the hospital and thus could be identified. The remaining 76.47 % sustained an

unknown or insect bite which was later treated as snake bite based on clinical evaluation and investigation. Among the patients who identified snake 74 % was saw scaled viper bite. 19 % identified the snake as Russell Viper and two patients who expired had sustained a Krait bite. The cause of death was coagulopathy.

ANALYSIS OF SYSTEMIC BLEEDING MANIFESTATIONS IN SNAKE BITTEN INDIVIDUALS

A total 14 patients out of 51 had systemic bleeding. Out of them 55 % presented with hematuria while 40 % had hematemesis and 5 % individuals had hemoptysis or gum bleed or sub-arachnoid hemorrhage.

ANALYSIS OF THE TIME INTERVAL BETWEEN SNAKE BITE AND ONSET OF COAGULATION ABNORMALITY

The time of onset of abnormal coagulation was analyzed based on two sets of findings. The first was based on the number of patients who had prolonged clotting time at the time of admission. 78 % of patients had abnormal clotting time at the time of admission. The average time period between the bite and hospital admission was 8 hours ranging from 3 to 13 hours.

The second group analysis has a set of 3 patients who had normal clotting time at the time of admission which become abnormal over a period of time. Two of them developed it in a period of 5 hours and the third patient by 13 hours. Thus it was concluded that the onset of abnormal coagulation occurred as early as 3 hours and late as 13 hours with a majority developing it in a average time of 8 hours.

All patients who had prolonged clotting time at admission also had prolonged PT. One patient who had initial normal clotting time and went on to develop abnormal coagulation had prolonged PT.

CORRELATION OF CLINICAL SEVERITY WITH QUANTITATIVE COAGULATION TESTS

Two quantitative tests namely platelet count and FDP were analyzed in relation to clinical severity.

Platelet count was normal in all patients belonging to grade I with an average of 2.3 lakhs / cu.mm. The average platelet count in grade II individuals was 1.01 lakhs / cu.mm. And grade III 90,400 / cu.mm. Thus individuals with

coagulation abnormality, it did not significantly correlate with severity of envenomation.

Blood FDP analysis done in patients of grade I showed no reduction, the average level was 245 mg / dl. Grade II patients had an average level of 166 mg / dl. Thus the level of serum fibrinogen was found to be decreasing with severity of envenomation

ANALYSIS OF THE TIME TAKEN FOR THE RETURN OF COAGULATION PROFILE TO NORMAL

The time taken for clotting time turn normal was analyzed in grades II and III. For proper standardization a fixed regimen of ASV was used. Clotting time was repeated every six hours and in certain cases at more frequent intervals. In grade II the average time taken for the clotting time to turn normal was 8.1 hours. The range was from 3 to 21 hours. In grade III individuals the average time taken for the clotting time normalization was 18 hours, the range being 6 to 24 hours. The average dose of ASV needed in grade II individuals was 13.8 (5 to 40 vials), in grade III 15.5 (10 to 30 vials)

The time taken for the return of PT, fibrinogen and platelet count to normal following ASV therapy was studied in four patients who had normal clotting time at admission though it was initially prolonged when managed in peripheral hospitals. PT, fibrinogen and platelet counts were abnormal in two patients in whom the test was done at forty eight hours. In two other patients in whom the test was done on 3rd and 5th day, only fibrinogen and platelet were abnormal. Thus the average time taken for normalization of PT was found to be 46 hours and while that taken for platelet count and fibrinogen to return to normal was longer.

Table : 4 ANALYSIS OF RELATIONSHIP BETWEEN THE TIME OF BITE INITIATION OF THERAPY, RETURN OF COAGULATION PARAMETERS TO NORMAL AND THE DEVELOPMENT OF COMPLICATIONS

Time of onset treatment (hours)	Grade	Number of cases	Average no. of ASV	Return of clotting time to normal	Number of cases with RF and / or shock
0 – 5	G II	12	14.5	8.8	2*
	G III	2	15	9	1
5 – 10	G II	8	14.5	8.7	2*
	G III	6	17	11.6	1
10 – 15	G II	4	10.5	10	0
	G III	2	11.5	11	0
>15	G II	3	8	7	1
	G III	2	15	20	1

*** PATIENTS ADMITTED WITH ESTABLISHED RENAL FAILURE TREATED OUTSIDE TMCH**

It is evident from analysis of the above table 4 showed that the time of onset of therapy doesn't correlate with the development of complications in

hospital-treated individuals. The incidence of renal failure and shock has been found to be equal in all time periods.

The return of clotting time to normal following therapy with ASV also didn't correlate with the time period between bite and onset of treatment.

The only correlating factor was found to be the severity of envenomation.

CORRELATION OF COMPARTMENT SYNDROME AND RENAL FAILURE

total number of patients with compartment syndrome	**17**
number of patients undergone fasciotomy	**05**
number of patients had renal failure (positive for urine myoglobulin)	**12**
number of patients undergone peritoneal dialysis	**10**

In our study in 5 patients of compartment syndrome who had underwent fasciotomy, the elevated renal parameters returned to normal within 2 to 4 days. Pain and swelling of the limbs subsided within 2 days and the patients were discharged early. One patient with compartment syndrome who had developed AKI with oliguria underwent peritoneal dialysis. It was found that patients got

admitted late after bite and compartment pressures in the patients were 60 mm Hg and 64 mm Hg.

In 12 patients with compartment syndrome who had not underwent fasciotomy, 10 cases went for peritoneal analysis, who had positive urine myoglobin. In all these cases compartment pressures were above 40 mm Hg. Only 2 cases didn't go for peritoneal dialysis. In these 2 patients the compartment pressures were 32 mm Hg and 34 mm Hg. These 2 patients had prolonged hospital stay.

NEURO PARALYSIS AND ITS TREATMENT MODALITIES

6 patients with neurotoxic envenoming were treated with antisnake venom 4 of them developed respiratory failure. A clear airway was maintained and cuffed endotracheal tube was inserted and connected to ventilator.

Patients with neurotoxic envenoming remained fully conscious with intact sensation. Although artificial ventilation was first suggested for neurotoxic envenomination more than 100 years ago, patients continue to die, because they did not have access to mechanical ventilation (non-availability or non-affordability).

Acetylcholine esterase have a variable but potentially useful effect in patients with neurotoxic envenoming especially when postsynaptic neurotoxin involved. Atropine sulphate (0.6 mg for adults) was given by intravenous injection followed by an intravenous injection of neostigmine methyl sulphate (50 - 100 microgram/kg). This does is repeated fourth hourly till the patient improves.

ANALYSIS OF INCIDENCE OF RENAL FAILURE IN RELATION TO ALTERATION IN COAGULATION PROFILE

In total 26 of the study population developed renal failure of which 10 % belonged to grade I, 56 % to grade II and 34 % to grade III. Patients in grade I who developed renal failure had a normal coagulation profile.

56 % of the renal failure was from grade II, but the important observation was 4 out of the 5 patients who developed renal failure in this group had developed the disease before hospitalization in Thanjavur Medical college hospital. They had been treated with low dose ASV (an average of 5 vials) in the peripheral centers before referral. Only one out of twenty seven patients belonging to grade II developed renal failure during hospital therapy. The average platelet count was 1.2 lakhs/cu.mm and fibrinogen level was 185 mg/dl.

In grade III, 3 out of 12 patients (25%) developed renal failure despite hospital treatment. The average platelet count was 85,000/cu.mm and fibrinogen level was 124 mg/dl.

All the patients in grade III who developed renal failure had hematuria which was absent in grade I and II. Out of 26 patients with renal failure, urine myoglobin was positive in 10 cases who had compartment syndrome.

Thus in conclusion, the severity of envenomation correlated with the development of renal failure in hospital treated individuals. As in case of severity, FDP level and positive urine myoglobin correlated well with development of renal failure than platelet count

RECURRENCE OF COAGULATION ABNORMALITY AFTER NORMALISATION WITH ASV THERAPY

Only one patient of the entire study population showed a recurrence of abnormal coagulation after initial normalization. When he was again treated with ASV and clotting time returned to normal after six hours.

ANALYSIS THE COMPLICATIONS OF ASV THERAPY

In this study, 12 out of 51 patient developed early anaphylactic reaction. Clinical features include itching, fever, tachycardia, palpitations, nausea and vomiting. Early reactions was managed by 0.5 ml of 0.1 % adrenaline subcutaneous and chlorpheneramine maleate 10 mg IV.

There was no pyrogenic reaction and late serum sickness.

ANALYSIS OF CARDIOVASCULAR AND CEREBROVASCULAR MANIFESTATION

In this study only 6 out of 51 patients had sinus tachycardia. All these 6 patient had neuroparalytic manifestation. No incidence of coronary artery disease or other cerebrovascular disease.

DISCUSSION

EPIDEMIOLOGICAL ASPECTS

The cauvery basin, comprising the areas in and around Thanjavur is highly fertile area. The primary occupation of the people in this area, for several generations, has been agriculture.

The abundance of farmland, which is the natural habitat of snakes such as the viper meant that there has been a constant high incidence of snake bite cases over the past several decades presenting to our institution, the commonest presentation has been with coagulation abnormalities. So to highlight the clinical profile and prognosis of this occupational hazard and sensitise the primary care physician, we decided to conduct a study on the various clinical features following snake bites.

The incidence of snake bite and its severity is well known to increase during the rainy season. In North India, 80 % of bites per annum occur between May and October while in North Kerala it occurs between October and January.

A total of 100 cases were admitted following snake bite in this period. Of these, 51 % had features of envenomation. Of which 84.32 % was hemotoxic, 11.76 % was neurotoxic and 3.92 % was of mixed type. The bite of poisonous snakes produces envenomation only in 50 % of cases. It is known in India, out of 236 species of snakes, only 50 are poisonous.

Commonly encountered snakes include krait, cobra, saw scaled viper and Russel viper.[2] Taking these into consideration, the incidence of envenomation has to be low compared to the total number of bites. Our study shows 51 % of snake bite victims had envenomation features. The high incidence may be due to the fact that large number of snake bite cases might have been treated at local hospital or referred here, as unknown reptilian bit and treated accordingly.

As we have mentioned already, the greater incidence of patients presenting with hemostatic abnormality 84.32 % compared to neurotoxic group 11.76 % may be related to the natural habitat of snakes, viper being the principal offender (farmland habitat).

Percentage of patients with bites in the lower limb in our study was 66.66% and upper limb 33.34 % because most of the patients were farmers

working barefoot on their farms. This correlated with other studies as shown by wai in 1974 (lower limb bite – 72 % upper limb bites – 25%, 3% other parts).

The average duration of hospital stay in our study was 6 days (ranges 2 to 28 days). The reason for prolonged hospitalization included the development of complications like renal failure and gangrene secondary to compartmental syndrome.

CHANGES OBSERVED IN COAGUALTION PROFILE

CLOTTING TIME

The study conducted by Reid reported 100 % prolongation of clotting time in all cases of definite envenomation.[11] In Orissa study, 95 % had a prolonged clotting time. In our study we noticed 79 % prolongation of clotting time.[30] 6.2 % of these developed abnormality after admission, 6 to 12 hours later. This emphasizes the fact that local cellulitis and lymphadenitis is an important clue for viper bite. Cases that had local features but normal clotting time, also may have to be treated with ASV as they may later develop coagulation abnormality as in 6 % of our cases or, may develop other complication such as unheralded renal failure (one case in our study). 3 patients had no local features but had prolonged clotting time. In conclusion, clotting time prolongation alone cannot be taken as a 100 % reliable indicator of hemotoxic envenomation. When clotting time was

considered with local features, the specificity was significantly increased (especially viper bite).

BLEEDING TIME

Only 10 % showed prolonged bleeding time in the study conducted in Orissa. The incidence reported by Reid was 5 %.

In our study, none of the patients, including those with systemic bleed, had an abnormal bleeding time. We infer that though platelet abnormality may be a contributory factor, it is not the major cause of bleeding.

PLATELET COUNT

Studies by both Reid and Mohapathra (in Orissa) showed as reduction in platelet count in 95 % and 93 % respectively.[15,32] Saini et al reported a 10 % incidence of reduced platelet counts.[30] We observed of reduced platelet counts. We observed a reduced platelet count in all cases (average count – 97,486/cu.mm) with prolonged clotting time. However there was no significant correlation with severity. Even patients having mucosal bleeds (hematuria, hematemesis) had only moderately reduced platelet counts (not sufficient to cause spontaneous bleeding)

and normal bleeding times. Hence we conclude that the effect of direct vasotoxic toxin – hemorrhagin" – must be a significant factor in causing mucosal bleeding.[33]

PROTHROMBIN TIME

Thrombin time, prothrombin time and activated partial thromboplastin time were prolonged in all cases in the Orissa study.[34] PT and TT were prolonged in all cases in Reid's study. The test was found to be prolonged even in the 5 % of cases where clotting time was normal. In our study the test was prolonged in all cases belonging to grades II and III envenomation (i.e, those with prolonged clotting times). In patients with normal clotting time, the test was prolonged in only one of the twelve. The significant finding was that this cases was one among the three that went on to develop prolongation of the clotting time later. In conclusion, as with other studies, PT, has shown prolongation in all cases with prolonged clotting time, indicating that venom activates both intrinsic and extrinsic pathway equally.

In patients with normal clotting times, the test was prolonged in all cases in the Orissan study, but in our case, only one of the patients belonging to this category showed similar results, and this patient went on to develop clotting abnormalities later. It has been stated that while the clotting time may be normal

even when clotting factors in the blood are at 1 % of normal amount, PT is prolonged below a value of 6 % of normal itself.[30] This suggests that the latter tests detect hemotoxicity earlier. However, further large scale studies, with more number of patients are needed to establish this. This average time taken for the normalization of these tests in our study was found to be 4 hours.

FIBRINOGEN DEGRADATION PRODUCT (FDP):

Blood fibrinogen degradation product was reduce in all patients belonging to grades II & III (average values 166.7 mgs % and 143.9 mgs % respectively). The reduction was proportionate to the severity. The other studies reported reduced fibrinogen in all cases with prolonged clotting time.[15,29]

In this study, we have attempted to find out which of disseminated intravascular coagulation or primary fibrinolysis was the underlying mechanism responsible for the coagulation abnormality.

Several international studies, including the one by Reid, and an Indian study by Mohapathra et al pinpointed DIC as the primary mechanism.[15,29]

However, a study by saint et al, involving 30 cases of snake bite, reported fibrinolysis as the primary mechanism.[35] Primary fibrinolysis, a relatively rare condition, is diagnosed by the presence of a combination of a normal platelet count, early lysis of formed clots, marked elevation of FDP, and negative tests for fibrin monomers (as tested by the protamine sulphate test). However, these findings were absent in our patients and hence we favor DIC as the primary mechanism. Furthermore, post mortem studies of the two cases who died with bleeding manifestations revealed changes suggestive of DIC.

To summarize the changes in the coagulation profile, it is found that snake activates both intrinsic and extrinsic pathway equally, with DIC as the main factor responsible for bleeding. This seems to suggests a role for the usage of heparin in the early phase of therapy. Platelets abnormalities may be a contributory mechanism, but are not primarily responsible. Spontaneous mucosal bleeds observed may be due to directly vasotoxic hemorrhagin.

COMMON SNAKEBITES PRESENTING AS BLEEDING DIATHESIS:

Only 27.45 % of our patients could identify the snakes they had been bitten, of which 70 % were Saw-scaled viper bite, Russel and 8 % Krait. Similar distributions have been reported by other workers.[11] The majority of victims

(72.55%) could not identify the snake they were bitten by and hence as suggested by Reid, we would like to emphasize that the treatment should be based more on the clinical presentation than on the identification of the snake.[15]

COMMON FORMS OF SYSTEMIC BLEEDING:

In this study, 52 % of patients with systemic bleeding had hematuria, 405 hematemesis, and the rest had hemoptysis or gum bleeding. Other common forms cited in literature are hemoptysis (Reid), and hematuria (Virmani et al from Kashmir).[36]

ONSET OF COAGULATION ABNORMALITY:

Practically, it is quite difficult to predict the exact time of onset of coagulation abnormality in a given case. As discussed earlier, the PT may be prolonged even before overt prolongation of the clotting time.

We used those patients who developed clotting abnormalities after admission to calculate the shortest (3 hours) and the longest (13 hours) interval between the bite and then onset of clotting abnormality.

The average interval, calculated by including the data from patients with bleeding diathesis at admission, was 7.15 hours.

QUANTITATIVE TEST IN RELATION TO CLINICAL SEVERITY:

The FDP level showed some correlation with clinical severity, with the level being 166 mg % in grade II and 143 mg % in grade III patients. As in other studies, none of other tests showed any correlation, including platelets count.

TIME TAKEN FOR NORMALISATION OF CLOTTING TIME:

Reid reported that the clotting time returned to normal in 9 hours with specific antiserum, and 24 hours with polyvalent serum alone were used, and we found the average time for normalization to be 7.9 hours in grade II and 18 hours in grade III envenomation. The time taken for PT to return to normal was 48 hours, similar to the finding in the Orissan study. For FDP and platelets counts to return to normal, it took 3 to 4 days approximately.

RELATIONSHIP BETWEEN TIME OF STARTING TREATMENT, DEVELOPMENT OF COMPLICATIONS, AND NORMALISATION OF CLOTTING TIME:

It was Reid who originally proved that the coagulation profile returned to normal rapidly with therapy, regardless of the time elapsed before the start of treatment.[11] The results of our study also suggest that both the probability of complications and the time taken to achieve normalization of coagulation both depended on the severity if the bite, and not the time elapsed before starting of treatment. On this basis and in 1968, we concluded that ASV can be effective even if given late and there is no time limit for starting ASV therapy.

RENAL FAILURE AND ITS RELATIONSHIP OF CLOTTING ABNORMALITIES:

Our study showed the incidence of renal failure (developing in hospital) to be 26 %. The distribution according to grades showed an increasing incidence in the severe grades from I, II, and III (20%, 20% and 60%) respectively. This points to the direct role for coagulation abnormality in the pathogenesis of renal failure. 4 cases were admitted in established renal failure, after receiving treatment outside. One patient belonging to grade I also develop renal failure, suggesting a direct effect of snake venom on the kidney was operational in this case. Among the

quantitative tests, only myoglobinuria fibrinogen depletion and low platelets counts correlated with the development of renal failure.

RECURRENCE OF CLOTTING ABNORMALITY AFTER INITIAL NORMALISATION:

Such an occurrence was seen only in one out of our 50 patients. This phenomenon according to Reid may occur in those cases where the initial doses of ASV were inadequate. Even our single patients was previously treated in the peripheral center and probably the initial dose, given there, was inadequate.[11] Therefore the results of our study do not recommend the continuance of ASV therapy following the normalization of clotting time, provided an adequate dose (according to grade of envenomation) has been given initially.

CONCLUSIONS

1. Hemotoxic envenomation was the commonest form of snake bite poisoning seen in this study.

2. Saw-scaled viper was the commonest snake causing coagulation abnormality while Krait was the most poisonous (in terms of mortality).

3. Onset of coagulation abnormality occurred as early as 3 hours and as late as 13 hours following snake bite. So all patients with history of snake bite should be under medical supervision for at least 24 hours.

4. In the diagnosis of Hemotoxic envenomation the presence of local signs plus a prolonged clotting time had a sensitivity of 100 %.

5. Prothrombin time appears to be prolonged earlier than clotting time needs further confirmation.

6. Among the quantitative coagulation tests only fibrinogen level was correlated with the severity of envenomation compared to platelet count.

7. The time interval between the bite and initiation of treatment was not found to be related to time taken for normalization of the coagulation abnormality or to the development of complication in this study.

8. Following ASV therapy, the time taken for normalization of clotting time was found to be around 8 hours in Grade II and 18 hours in Grade III individuals.

9. Direct effect of venom on the kidney was also found to play a role along with disseminated intravascular coagulation and pigment Nephropathy in the causation of renal failure.

10. This Study shows that early and adequate fasciotomy reduces the necrosis of the bitten limb by 100 % and acute renal failure by 83 %.

11. Since majority of snake bites are in lowerlimbs, farmers and labourers may be advised to wear shoes during work.

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MASTER CHART

S.No	Name	sex	Age	b	Si	Grd	Assf	Syb	CT	Bt	Plt	Pt	Fib	Cho	Ud	umg	AB	AA	Rf	Pd	Bni	Nt	co	cad/cva
1	Mariappan	M	53	U	RA	G1	-	-	12'	2.1	240000		212	148	No Rbc	-	10	0	-	-	4	-	G	-
2	Thangalakshmi	F	28	U	LF	G2	CS	-	Id	3.4	130000	18	180	156	No Rbc	+	20	0	+	1	5	8	A	-
3	Megala	F	30	S	RF	G3		hmtu	Id	4.1	88000	20	148	172	Rbc	-	15	5	-	-	12	18	A	-
4	Lakshmi	F	35	K	LF	G2	CS	-	10'	3.1	120000	20	198	182	No Rbc	-	15	0	+	1	6.5	4	E	-
5	chithra	F	25	U	LA	G1	Shock	-	7'	5.4	240000		220	168	No Rbc	-	20	0	+	-	7.5	-	A	-
6	Lavanya	F	25	U	LF	G2	CS	-	Id	4.2	140000	22	184	178	No Rbc	+	15	10	+	-	1	12	A	-
7	Kalavathi	F	35	S	LF	G3		hmtu	Id	4.8	88000		130	182	Rbc	-	20	0	-	-	13	18	G	-
8	Arthi	F	35	U	RF	G2		-	Id	3.2	120000	18	200	140	No Rbc	-	10	0	+	-	18	16	G	-
9	Rajeswari	F	35	U	LF	G2	CS	-	Id	3.8	130000		196	160	No Rbc	+	10	0	+	2	9	14	A	-
10	Selvi	F	40	U	RF	G3		hmtu	Id	4.8	84000	22	146	142	Rbc	-	15	5	+	-	7	12	A	-
11	Kavitha	F	25	S	RA	G1		-	8'	5.2	260000	14	240	172	No Rbc	-	5	0	-	-	40	-	G	-
12	Mayilsamy	M	41	R	LA	G2-G1		-	Id	4.2	1240000	18	172	170	No Rbc	-	10	5	-	-	3	40	G	-
13	Raju	M	30	U	LF	G2		-	Id	3.8	1260000	20	178	160	No Rbc	-	10	0	-	-	4.5	7	G	-
14	Naveen	M	13	U	RF	G3	CS	hmtu	Id	4.8	82000	18	146	178	Rbc	-	15	0	+	1	6.5	8.5	A	-
15	Vinoth	M	18	S	LF	G1		-	7'	5.2	240000	14	214	142	No Rbc	-	0	10	-	-	9.5	4	A	-
16	Kalpana	F	28	K	LF	G2	CS	-	Id	4.9	140000	16	168	146	No Rbc	+	15	0	+	1	6	8	E	-
17	Velmurugan	M	23	U	RF	G3	-	hmtu	Id	4.6	86000	24	138	152	Rbc	-	15	0	-	-	17	16	A	-
18	Nagaraj	M	35	U	RA	G2	CS	-	Id	5.4	166000	22	168	146	No Rbc	+	10	0	+	-	12	8	A	-
19	Vanitha	F	15	U	RF	G3	Shock	hmts	Id	0	84000	24	138	182	No Rbc	-	15	0	-	-	14	7	G	-
20	Preetha	F	19	S	LF	G2	CS	-	Id	3.2	140000	18	172	156	No Rbc	-	10	0	+	1	8.5	12	A	-
21	Kalaiselvan	M	17	U	LA	G2	-	-	Id	3.6	146000	16	192	140	No Rbc	-	10	0	-	-	6	8	A	-
22	Chandrasekar	M	18	S	RF	G3	-	hmtu	Id	4.1	86000	22	142	120	Rbc	-	15	5	-	-	4	6	G	-
23	Nivin	M	15	U	LF	G1-G2	-	-	8"	0	260000	14	212	130	No Rbc	-	0	0	+	-	6.5	0	A	-
24	Selvam	M	13	U	LF	G2	-	-	Id	4.6	130000	18	178	126	No Rbc	-	15	0	-	-	8.5	6	A	-
25	Moorthy	M	40	S	LA	G2	Shock	-	Id	5.4	96000	16	172	184	No Rbc	-	15	0	-	-	9	15	G	-
26	Shakthi	M	43	U	LF	G2	-	-	Id	0	130000	-	180	162	No Rbc	-	10	5	+	1	3	12	A	-
27	Selvaraj	M	55	U	RA	G3	CS	hmts	Id	4.8	84000	-	140	148	No Rbc	+	15	0	+	-	4	14	A	-
28	Raja	M	33	R	RA	G3	-	hmts	Id	5.2	88000	-	138	134	No Rbc	-	20	0	+	-	10	10	A	-
29	Periyasamy	M	30	U	LF	G2	-	-	10"	0	140000	20	168	154	No Rbc	-	5	10	+	-	12	-	A	-
30	Krishnan	M	45	U	RF	G2	-	-	Id	4.2	160000	18	192	162	No Rbc	-	15	0	-	-	14	8.5	G	-
31	Chelladurai	M	55	U	RF	G3	CS	hmts	Id	3.8	82000	20	138	170	No Rbc	+	15	15	+	-	16	4.5	A	-
32	Sasi	M	16	U	LF	G1	-	-	11"	0	240000	-	220	140	No Rbc	-	0	0	-	-	4	-	G	-
33	Mayilkumar	M	20	U	RF	G2	CS	-	Id	4.1	110000	18	180	172	No Rbc	+	15	0	+	2	8	4	A	-
34	Sundaram	M	55	U	LA	G2	-	-	Id	4.6	160000	-	186	146	No Rbc	-	15	5	-	-	10	8	G	-
35	Vijay	M	23	S	LF	G1	-	-	12"	3.1	220000	20	220	174	No Rbc	-	0	10	-	-	5	-	G	-
36	Suriya	M	19	U	LF	G2	Shock	-	Id	4.8	98000	-	184	148	-	-	15	0	+	1	3.5	7	A	-
37	Murugesan	M	63	U	RA	G2-G1	-	gum	Id	3.4	120000	22	192	158	No Rbc	-	20	0	-	-	1	12	G	-

38	Manikandan	M	62	U	RF	G1	-	-	9"	4.6	260000	14	240	162	No Rbc	-	0	0	-	-	3	-	G	-
39	Nishanth	M	18	U	LA	G3	CS	hmtu	Id	3.2	94000	-	140	178	Rbc	+	15	5	+	-	7	14	A	-
40	Kumar	M	45	S	LF	G2	CS	-	Id	4.2	126000	-	196	180	No Rbc	-	20	0	+	1	17	16	A	-
41	Ramasamy	M	49	U	RA	G1	-	-	10"	4.6	240000	-	210	160	No Rbc	-	5	0	-	-	5.5	-	G	-
42	Sekar	M	33	U	RF	G2	CS	-	Id	4.8	98000	18	192	140	No Rbc	+	15	0	+	-	6	12	A	-
43	Arumugam	M	37	U	LA	G2	-	-	Id	3.4	124000	.-	196	130	No Rbc	-	10	5	-	-	5	8	G	-
44	Kannan	M	47	U	RF	G1	-	-	12"	3.6	260000	14	260	126	No Rbc	-	5	0	-	-	8	-	A	-
45	Balan	M	45	R	RA	G2	CS	-	Id	3.8	128000	20	180	134	No Rbc	-	15	0	+	1	5	14	A	-
46	Jeevan	M	18	U	LF	G2	-	-	Id	4.1	130000	-	174	142	No Rbc	-	20	0	-	-	1	18	G	-
47	Loganathan	M	37	U	LA	G2	-	-	Id	4.6	140000	20	176	162	No Rbc	-	15	0	-	-	3	12	G	-
48	Veerakumar	M	55	U	RF	G1-G2	-	-	8"	0	268000	14	160	166	No Rbc	-	5	10	-	-	6	-	G	-
49	Ravikumar	M	37	U	RA	G2	CS	-	Id	4.8	110000	18	178	176	No Rbc	-	10	0	+	-	7	17	A	-
50	Vasu	M	25	U	RF	G3	CS	hmtu	Id	5.2	91000	-	140	180	Rbc	-	15	0	+	-	8	10	A	-
51	Ravichandran	M	36	U	RF	G1	CS			4.2	120000													-
52	Naveena	F	18	U	LF	G0	Nil	-	10'	3.4	260000	14	180	156	No Rbc	-	_	_	-	-	5	-	A	-
53	Sundaravalli	F	30	S	RF	G0	Nil	-	12'	4.1	288000	13	148	172	No Rbc	-	_	_	-	-	12	-	A	-
54	Udhayakala	F	35	K	LF	G0	Nil	-	10'	3.1	220000	12	198	182	No Rbc	-	_	_	-	-	6.5	-	E	-
55	Jothi	F	25	U	LA	G0	Nil	-	7'	3.6	240000	14	220	168	No Rbc	-	_	_	-	-	7.5	-	A	-
56	Karthika	F	25	U	LF	G0	Nil	-	10'	4.2	240000	12	184	178	No Rbc	-	_	_	-	-	1	-	A	-
57	Selvi	F	15	S	LF	G0	Nil	-	12'	4.8	388000	10	130	182	No Rbc	-	_	_	-	-	13	-	G	-
58	Akila	F	35	U	RF	G0	Nil	-	8'	3.2	220000	16	200	140	No Rbc	-	_	_	-	-	18	-	G	-
59	Jeyalakshmi	F	35	U	LF	G0	Nil	-	7'	3.8	230000	13	196	160	No Rbc	-	_	_	-	-	9	-	A	-
60	Revathi	F	40	U	RF	G0	Nil	-	9'	4.8	384000	12	146	142	No Rbc	-	_	_	-	-	7	-	A	-
61	Angel	F	15	S	RA	G0	Nil	-	8'	5.2	260000	14	240	172	No Rbc	-	_	_	-	-	40	-	G	-
62	Sundaram	M	21	R	LA	G0	Nil	-	14'	4.2	240000	16	172	170	No Rbc	-	_	_	-	-	3	-	G	-
63	Sivabalan	M	30	U	LF	G0	Nil	-	12'	3.8	260000	12	178	160	No Rbc	-	_	_	-	-	4.5	-	G	-
64	AriVazhagan	M	13	U	RF	G0	Nil	-	13'	4.8	282000	14	146	178	No Rbc	-	_	_	-	-	6.5	-	A	-
65	Nataraj	M	18	S	LF	G0	Nil	-	7'	4.2	240000	14	214	142	No Rbc	-	_	_	-	-	9.5	-	A	-
66	Thenmozhi	F	28	K	LF	G0	Nil	-	10'	4.9	240000	16	168	146	No Rbc	-	_	_	-	-	6	-	E	-
67	Manikandan	M	23	U	RF	G0	Nil	-	13'	4.6	288000	14	138	152	No Rbc	-	_	_	-	-	17	-	A	-
68	Moorthi	M	35	U	RA	G0	Nil	-	7'	5.4	266000	12	168	146	No Rbc	-	_	_	-	-	12	-	A	-
69	Chithra	F	15	U	RF	G0	Nil	-	15'	2.4	284000	14	138	182	No Rbc	-	_	_	-	-	14	-	G	-
70	Kanchana	F	19	S	LF	G0	Nil	-	14'	3.2	240000	16	172	156	No Rbc	-	_	_	-	-	8.5	-	A	-
71	Selvam	M	17	U	LA	G0	Nil	-	9'	3.6	246000	16	192	140	No Rbc	-	_	_	-	-	6	-	A	-
72	Joseph	M	18	S	RF	G0	Nil	-	8'	4.1	386000	12	142	120	No Rbc	-	_	_	-	-	4	-	G	-
73	Murugesan	M	15	U	LF	G0	Nil	-	8'	3.4	260000	14	212	130	No Rbc	-	_	_	-	-	6.5	-	A	-
74	Veeravel	M	13	U	LF	G0	Nil	-	12'	4.6	230000	12	178	126	No Rbc	-	_	_	-	-	8.5	-	A	-
75	Manivasagam	M	40	S	LA	G0	Nil	-	10'	2.6	296000	16	172	184	No Rbc	-	_	_	-	-	9	-	G	-
76	Mariappan	M	43	U	LF	G0	Nil	-	12'	3.4	330000	12	180	162	No Rbc	-	_	_	-	-	3	-	A	-

77	Kousalya	M	55	U	RA	G0	Nil	-	8'	4.8	384000	12	140	148	No Rbc	-	_	_	-	-	4	-	A	-
78	Periyasamy	M	13	R	RA	G0	Nil	-	12'	5.2	288000	14	138	134	No Rbc	-	_	_	-	-	10	-	A	-
79	Chinnappan	M	30	U	LF	G0	Nil	-	10'	0	240000	12	168	154	No Rbc	-	_	_	-	-	12	-	A	-
80	Dhanapal	M	45	U	RF	G0	Nil	-	12'	4.2	260000	14	192	162	No Rbc	-	_	_	-	-	14	-	G	-
81	Balu	M	55	U	RF	G0	Nil	-	8'	3.8	282000	12	138	170	No Rbc	-	_	_	-	-	16	-	A	-
82	Karthick	M	16	U	LF	G0	Nil	-	11'	0	240000	14	220	140	No Rbc	-	_	_	-	-	4	-	G	-
83	Dhanasekar	M	20	U	RF	G0	Nil	-	14'	4.1	253000	12	180	172	No Rbc	-	_	_	-	-	8	-	A	-
84	Muthusamy	M	55	U	LA	G0	Nil	-	10'	4.6	196000	16	186	146	No Rbc	-	_	_	-	-	10	-	G	-
85	Sekar	M	23	S	LF	G0	Nil	-	12'	3.1	220000	12	220	174	No Rbc	-	_	_	-	-	5	-	G	-
86	Ravikumar	M	19	U	LF	G0	Nil	-	9'	4.8	268000	14	184	148	No Rbc	-	_	_	-	-	3.5	-	A	-
87	Raja	M	63	U	RA	G0	Nil	-	6'	3.4	220000	12	192	158	No Rbc	-	_	_	-	-	1	-	G	-
88	Arumugam	M	62	U	RF	G0	Nil	-	9'	4.6	260000	14	240	162	No Rbc	-	_	_	-	-	3	-	G	-
89	Vinoth	M	18	U	LA	G0	Nil	-	10'	3.2	294000	14	140	178	No Rbc	-	_	_	-	-	7	-	A	-
90	Mani	M	45	S	LF	G0	Nil	-	14'	4.2	196000	12	196	180	No Rbc	-	_	_	-	-	17	-	A	-
91	Kumaresan	M	49	U	RA	G0	Nil	-	10'	4.6	240000	14	210	160	No Rbc	-	_	_	-	-	5.5	-	G	-
92	Ponuvel	M	33	U	RF	G0	Nil	-	14'	4.8	258000	15	192	140	No Rbc	-	_	_	-	-	6	-	A	-
93	Rajakannu	M	37	U	LA	G0	Nil	-	12'	3.4	254000	12	196	130	No Rbc	-	_	_	-	-	5	-	G	-
94	Pandian	M	47	U	RF	G0	Nil	-	12'	3.6	260000	14	260	126	No Rbc	-	_	_	-	-	8	-	A	-
95	Velmurugan	M	45	R	RA	G0	Nil	-	14'	3.8	258000	12	180	134	No Rbc	-	_	_	-	-	5	-	A	-
96	Gowtham	M	18	U	LF	G0	Nil	-	6'	4.1	280000	14	174	142	No Rbc	-	_	_	-	-	1	-	G	-
97	Sathish kumar	M	37	U	LA	G0	Nil	-	8'	4.6	290000	12	176	162	No Rbc	-	_	_	-	-	3	-	G	-
98	Thangavel	M	55	U	RF	G0	Nil	-	8'	4.2	268000	14	160	166	No Rbc	-	_	_	-	-	6	-	G	-
99	Poovarasan	M	37	U	RA	G0	Nil	-	10'	4.8	260000	14	178	176	No Rbc	-	_	_	-	-	7	-	A	-
100	Anand	M	25	U	RF	G0	Nil	-	12'	3.8	201000	12	140	180	No Rbc	-	_	_	-	-	8	-	A	-

ABBREVIATIONS

S.NO - serial number

SI - site

IP - In Patient number

DOA - Date of admission

R - Russell's viper

HMTU - Hematuria

Gu - Gum Bleed

Syb - Systemic Bleed

S - Saw scaled viper

Co - Clinical outcome

G1-2 - Initial G1 after admission G2

G2-1 - Initial G2 after admission G1

M - Male

F - Female

U - Unknown

LF - Left Foot

RF - Right Foot

LA - Left Arm

RA - Right Arm

HMTS - Hemetemesis

Assf - Associated Features

A - Average

G - Good

E - Expired

X - sex

K - Kraitt

Grd - Grade

G1 - Grade 1

G2 - Grade 2

G3 - Grade 3

ID - In Definite

Plt - Platelet count in lakhs

Bt - bleeding time in minutes

Ct - Clotting time in minutes

Pt - Pro thrombin in seconds

Bni - Bite needle interval in hours

Aa - Number of ASV given after clotting normalisation

Ab - Number of ASV given before clotting normalisation

Nt - Normalisation of clotting time in hours after ASV therapy

Fib - Fibrinogen mg%

UD - Urine Deposits

Cho - Cholesterol mg%

UMG - Urine myoglobulin

CS - Compartment Syndrome